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COVER LETTER

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24 Maret 2021

Dear,
We wish to submit an original research article entitled “Development of a smart system for gasoline car emissions diagnosis using Bayesian Network” for consideration by SINERGI.

We confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere.

In this paper, we report on / show that:

Topic	:	Development of a smart system for gasoline car emissions diagnosis using Bayesian Network
Brief Background	:	The total population of Indonesia is 268 million people, currently, more than 55% own a motorized vehicle, be it a motorcycle or a car. Therefore, the fuel needed and the need for maintenance of the engine are also very important [1]. The increasing number of engine vehicles in Indonesia will affect or pollute healthy air conditions into unhealthy air conditions in the environment, this happens because the exhaust gases generated in these engine vehicles contain unhealthy gases such as carbon monoxide (CO), hydrocarbons (HC), and others. It is conceivable that more than 55% of the Indonesian population currently owns a motorized vehicle, especially a car and does not know how to diagnose the exhaust emission test results, resulting in a lack of awareness to carry out routine maintenance properly. The need for good air conditions, namely oxygen, is currently getting worse and depleting for Indonesia and the world [2]–[5]. The vehicle emission test is the residual combustion product from the fuel in the vehicle engine that is released through the engine exhaust system, while the combustion process is a chemical reaction between oxygen in the air and hydrocarbon compounds in the fuel as a power producer [6]–[8]. Exhaust emissions from motor vehicles are the main source of air pollution originating from transportation as well as the work of

		the combustion engine of the motor vehicle. The results of this emission test can also be used to determine if there is damage to the engine parts of the vehicle, and to adjust the air and fuel mixture properly. Currently, in conducting vehicle exhaust emission tests, many do not know about the benefits of the data obtained in the emission test, while in the treatment the data obtained are very large. To make it easier for the general public to know the data obtained from the emission test, the authors aim to implement a Bayesian Network (BN) to diagnose the emission measurement results [9], [10]. This BN as using the previous statistical information was then successful in many practices and uses and implementation. The BN method is used in research because this tool is very suitable in giving a decision from a certain indication. BN's decision is to process data from a trained repository which will then be retrieved with cross-validation data. BN is a probability-based data modeling method that represents a set of variables and their conditional dependencies through a Directed Acyclic Graph (DAG). Each node that is formed in the graph has a Conditional Probability Table (CPT) [11]–[14]. BN provides a useful tool because it represents a probability relationship between a cause and a symptom or between a symptom and an error. It can also represent a multi-fault and multi-symptom model [15]–[20]. In addition, it can effectively analyze the complex causal relationship between the BN node by its inference and sensitivity method. In addition, the structure of the causal network can be adapted flexibly by simply adding nodes and arcs to the existing BN model [21]. Although several BN based approaches such as El Amrani [22] and Li [23] have been previously developed for inference of diagnostic results, there are still limitations in developing network modeling for diagnosis of BN based emission measurement results. In this study, we apply BN for emission data identification, emission diagnosis inference, and analysis of accuracy in reading Toyota car emission measurement results [24]–[27]. Based on the importance of knowing the value of vehicle emissions and the ability of the BN method in making decisions, we aim to create a smart application to diagnose the measurement results of Toyota car emissions using the BN method.
Research Problem	:	Emission test kits on the market generally can only measure substances contained in vehicle exhaust emissions. These tools are not equipped with the ability to diagnose emission

		conditions. The process of reading the measurement results to produce whether the emission is good or not is quite long. Diagnosis using existing tools should be carried out by an expert. It is not yet known the success of the application of Bayesian Networks in the design of a gas emissions diagnostic system.
Overview of Method	:	The system was designed using MSBNX and MATLAB software comprising of several implementation stages. It starts by determining the related variables and categories in the network, making a causality diagram, determining the prior probability of the variable, filling in the conditional probability of each variable, and entering evidence to analyze the diagnosis results. Then proceed with conducting test cases on emission data to display probability inferences in each emission content.
Significant finding	:	• The new Bayesian Networks model • The implementation method of diagnosis emission gas of vehicle system and Bayesian Networks • Creating new software and design interface

We have no conflicts of interest to disclose.

Thank you for your consideration of this manuscript.

Sincerely,

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AUTHORSHIP STATEMENT

We wish to submit an original research article entitled "*Development of a smart system for gasoline car emissions diagnosis using Bayesian Network*" for consideration by SINERGI.

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript.

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POTENTIAL REVIEWERS

Please submit 3 (three) potential reviewers (*that have not listed in SINERGI*) to speed up the review process that competent for the topic and has a good reputation in that area.

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